

(19) Japan Patent Office (JP)		(12) Japanese Unexamined Patent Application Publication (A)		(11) Unexamined Patent Application Publication Number	
				H5-215474	
				(43) Publication date 24 August 1993	
(51) Int. Cl. ³	Identification symbols	Internal file number	FI	Technical indications	
F28D 1/053 F28F 9/02	Z 301 D	7153B3L 9141B3L			
Request for examination: Not filed Number of claims: 1 (6 pages total)					
(21) Application number	H3-155585	(71) Applicant	000186843		
(22) Filing date	30 May 1991				
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(54) (Title of invention) HEAT EXCHANGER

(57) (Abstract)

(Objective) To provide a heat exchanger with a multilayer header structure which allows the header and core to be integrally joined without performing so-called welding operations.

(Constitution) A partition element 13 is provided in the inner part of at least one header 1, extending in the longitudinal direction of said header and describing multiple passages 1a and 1b in said inner part; through-holes are perforated in this partition element 13, and a certain number of tubes from among the multiple tubes 7 are passed through these through-holes, integrally joining the core and the headers at the same time. Thus, a fluid flowing from one header 1 into the core zigzags through multiple passages 1a, 1b, 3a, 3b and multiples tubes 7aB7c and is discharged from that one header or from the other header 3.

[see source for figure]

(Scope of patent claims)

(Claim 1) A heat exchanger forming a core with multiple tubes arranged substantially perpendicularly between a pair of headers, distinguished in that it is constituted such that a partition element is provided in the inner part of at least one header, extending in the longitudinal direction of said header and describing multiple passages in said inner part; through-holes are perforated in this partition element, and a certain number of tubes from among said multiple tubes are passed through these through-holes, integrally joining said core and said headers at the same time; and a fluid flowing from one header into the core is made to zigzag through said multiple passages and said multiples tubes and is discharged from that one header or from the other header.

(Detailed description of the invention)**(0001)**

(Field of industrial application) The present invention relates to a heat exchanger comprising a multilayer header structure.

(0002)

(Prior art) Heat exchangers used in industrial oil coolers, automobile evaporators, condensers and the like are commonly known.

(0003) In these sorts of devices, as shown in Figure 13, flat plates 71, corrugated fins 73 and flow path forming elements 75 are arranged side by side, with spacer bars 77 interposed between them, which are all joined integrally to form a core 79, and then the header 81 is welded to the top and bottom edges (for example, Japanese Unexamined Utility Model Application Publication S63-109869). 83 is a partition plate, and the headers 81a and 81b connected to both sides of this partition plate 83 are connected as separate elements.

(0004)

(Problem to be solved by the invention) However, with the conventional arrangement, there is the problem that, after forming the core 79, the headers 81, 81a and 81b need to be welded to the top and bottom edges thereof, and since the weld is relatively long, the operation is troublesome.

(0005) In this connection, the objective of the present invention is to provide a heat exchanger with a multilayer header structure which allows the header and core to be integrally joined without performing so-called welding operations, resolving the aforementioned problems of the prior art.

(0006)

(Means of solving the problem) To achieve the aforementioned objective, the present invention is distinguished in that, a heat exchanger forming a core with multiple tubes arranged substantially perpendicularly between a pair of headers is constituted such that a partition element is provided in the inner part of at least one header, extending in the longitudinal direction of said header and describing multiple passages in said inner part; through-holes are perforated in this partition element, and a certain number of tubes from among said multiple tubes are passed through these through-holes, integrally joining said core

and said headers at the same time; and a fluid flowing from one header into the core is made to zigzag through said multiple passages and said multiples tubes and is discharged from that one header or from the other header.

(0007)

(Function) According to the present invention, by employing a so-called multilayer header structure, a heat exchanger can be manufactured in an extremely simple manner, just by arranging the tubes between a pair of headers, passing a certain number of tubes from among the multiple tubes through through-holes in the header partition

element to establish multiple passages between the pair of headers and integrally join the core and headers at the same time, without performing any welding operations or the like. Furthermore, the inlets and outlets can be mounted at any position on the headers, so the mounting position of the inlets and outlets is not limited to the vertical direction of the core, allowing the mounting arrangement of the heat exchanger to be determined arbitrarily.

(0008)

(Embodiment examples) Below, an embodiment example of the present invention is described with reference to figures 1 through 6.

(0009) Figure 1 and Figure 2 show an industrial oil cooler, with captions 1 and 3 each indicating an aluminum header, arranged in a pair facing each other. This pair of headers 1 and 3 is made from extruded shaped elements, with an outer passage 1a, 3a and an inner passage 1b, 3b formed inside each of them, separated by a partition wall 13, as shown in Figure 3. Multiple aluminum fins 5 are arranged between this pair of headers 1 and 3, and multiple aluminum tubes 7 are arranged perpendicular thereto, thereby forming the core of the heat exchanger. 9 is an aluminum side plate.

(0010) The tubes 7 include three types: a first tube 7a which connects the outer passage 1a of the first header 1 with the inner passage 3b of the other header 3; a second tube 7b which connects the inner passage 1b of the first header 1 with the inner passage 3b of the other header 3; and a third tube 7c which connects the inner passage 1b of the first header 1 with the outer passage 3a of the other header 3.

(0011) Each tube 7aB7c, as shown in Figure 4, passes through the inner wall 11 of the headers 1 and 3 or the partition wall 13, and is joined there without gaps. Here, the partition wall 13 constitutes the partition element, and this partition element 13 is perforated with through-holes 13a for passing through the tubes 7. In this embodiment example, after placing a brazing sheet 15 over the inner wall 11 of the headers 1 and 3, each tube 7aB7c is joined once with the headers 1 and 3 by brazing.

(0012) Here, if the headers 1 and 3 have a structure like a seam welded pipe, for instance pre-coated with solder, the tubes 7aB7c can be joined to headers 1 and 3 by brazing as is. In this case, it suffices to lay the seam welded pipes together and join them once by brazing, as shown in Figure 5. The lateral cross-section of the tubes 7aB7c is wave-shaped, as shown in Figure 6. Thus, they have a good radiating efficiency.

(0013) Next, the function of this embodiment example is described.

(0014) In Figure 1, 21 is an inlet and 23 is an outlet. The fluid (oil) flows from the inlet 21 into the outer passage 1a of the first header 1, after which it passes through multiple first tubes 7a and enters once into the inner passage 3b of the other header 3. Thereafter, it passes through multiple second tubes 7b and now enters into the inner passage 1b of the first header 1, from where it passes through multiple third tubes 7c and enters the outer passage 3a of the other header 3, and from there

flows out through the outlet 23.

(0015) Furthermore, according to this embodiment example, by employing a multilayer header structure, the heat exchanger (industrial oil cooler) can be manufactured in an extremely simple manner, without performing any welding operations, etc. as in the prior art. Moreover, according to this embodiment example, fluid flowing in from the inlet 21, after flowing into the outer passage 1a of the header 1, passes through multiple first tubes 7a arranged substantially at an equal spacing in the longitudinal direction of the header 1, and enters once into the inner passage 1b of the other header 3, making the temperature distribution uniform over the entire core and allowing the efficiency of heat exchange to be improved.

(0016) Figure 7 shows an automobile evaporator (or condenser). In this example, an outer passage 31a, 33a and an inner passage 31b, 33b are formed, separated by a partition wall 45, inside the aluminum headers 31 and 33, and multiple aluminum tubes 37 are arranged between the pair of headers 31 and 33 perpendicularly thereto.

(0017) The tubes 37 include three types: a first tube 37a which connects the outer passage 31a of the first header 31 with the inner passage 33b of the other header 33; a second tube 37b which connects the inner passage 31b of the first header 31 with the inner passage 33b of the other header 33; and a third tube 37c which connects the inner passage 31b of the first header 31 with the outer passage 33a of the other header 33.

(0018) Each tube 37aB37c, as shown in Figure 8, passes through the peripheral wall 46 of the headers 31 and 33 or the partition wall 45, and is joined there without gaps. Here, the partition wall 45 constitutes the partition element, and this partition element 45 is perforated with through-holes (not illustrated) for passing through the tubes 37. In this example, the headers 31 and 33 are formed from seam welded pipe, so the tubes 37aB37c can be joined as is to the headers 31 and 33 by brazing.

(0019) The headers 31 and 33 may be fashioned for instance as shown in Figure 9. In this example, the headers 31 and 33 have a double tube structure, with the inner side of the partition tube 47 forming the inner passage 49b and the outer side of the partition tube 47 forming the outer passage 49a. Here, the partition tube 47 constitutes the partition element, which partition element is of course perforated with through-holes (not illustrated) for passing through the tubes 37.

(0020) Next, the function of this embodiment example is described.

(0021) In Figure 7, 41 is an inlet and 43 is an outlet. The fluid (coolant) flows from the inlet 41 into the outer passage 31a of the first header 31, after which it passes through five first tubes 37a and enters into the inner passage 33b of the other header 33. Thereafter, it passes through three second tubes 37b and now enters into the inner passage 31b of the first header 31, from where it passes through two third tubes 37c and enters the outer passage 33a of the other header 33, and then flows out through the outlet 43.

(0022) Furthermore, according to this embodiment example, since the number of tubes 37aB37c passed through gradually decreases from five to three and from three to two as the fluid moves from the inlet 41 toward the outlet 43, it is possible to ensure the same performance as in the prior art.

(0023) Furthermore, according to this embodiment example, the inlet 41 and outlet 43 can be mounted at any position on the headers 31 and 33, so the mounting position of the inlet 41 and outlet 43 is not limited to the vertical direction of the core, making it possible to arbitrarily determine the mounting arrangement of the heat exchanger.

(0024) Above, the present invention was described based on individual embodiment examples, but it is clear that the present invention is not limited thereto.

(0025) Namely, with a multilayer header structure, various modified applications are possible, such as not providing a partition element in the first header 51 and providing a partition element only in the other header 53, as shown in Figure 10, or providing one partition element 55a or 57a in both headers 55 and 57, as shown in Figure 11, or providing one partition element 59a in the first header 59 and providing two partition elements 61a and 61b in the other header 61.

(0026)

(Effect of the invention) As is clear from the above description, according to the present invention, a partition element is provided in the inner part of at least one header, extending in the longitudinal direction of said header and describing multiple passages in said inner part; through-holes are perforated in this partition element, and a certain number of tubes from among multiple tubes are passed through these through-holes, integrally joining the core and the headers at the same time; and a fluid flowing from one header into the core is made to zigzag through multiple passages and multiple tubes and is discharged from that one header or from the other header, thereby making any welding operations unnecessary and allowing

the heat exchanger to be manufactured in a simple manner. Furthermore, since the position of the inlet and outlet is not restricted, there is no restriction on the mounting arrangement, providing various beneficial effects, such as a high level of convenience in terms of assembly.
(Brief description of the drawings)

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(Figure 1) A front view showing an embodiment example of a heat exchanger (oil cooler) according to the present invention.

(Figure 2) A side view of the same.

(Figure 3) A cross-sectional view of the header of the same.

(Figure 4) A cross-sectional view showing the state with tubes inserted into the header of the same.

(Figure 5) A cross-sectional view showing another embodiment example.

(Figure 6) A cross-sectional view of a tube.

(Figure 7) A front view showing another embodiment example (automobile evaporator).

(Figure 8) A cross-sectional view showing the state with the tube inserted into the header of the same.

(Figure 9) A cross-sectional view showing another embodiment example of the same.

(Figure 10) A front view showing another embodiment example of the header structure.

(Figure 11) A front view showing another embodiment example of the header structure.

(Figure 12) A front view showing another embodiment example of the header structure.

(Figure 13) A front view showing a conventional heat exchanger.

1, 3	Header	
1a, 3a, 31a, 33a, 49a		Outer passage
1b, 3b, 31b, 33b, 49b		Inner passage
7	Tube	
7a	First tube	
7b	Second tube	
7c	Third tube	
21, 41	Inlet	
23, 43	Outlet	

[see source for figures]

Figure 1Figure 6

Figure 2Figure 3

Figure 10

[see source for figures]

Figure 4Figure 5

Figure 7

Figure 8Figure 9

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[see source for figures]

Figure 11Figure 12

Figure 13

